PATENT SPECIFICATION

Application Date: Feb. 9, 1934. No. 4401/34. **433,531**

Complete Specification Left: March 11, 1935.

Complete Specification Accepted: Aug. 9, 1935.

PROVISIONAL SPECIFICATION

Improvements in or relating to Vibration Dampers for Vehicles

I, JOHN ALEXANDER GILMORE, a British Subject, of The University, P.O. Box. 594, Cape Town, South Africa, do hereby declare the nature of this invention to be as follows:—

This invention is for improvements in or relating to vibration dampers for vehicles. It is well known that in automobiles undesirable vibrations occur in various parts, which vibrations should, where possible, be damped. These vibrations may be set up, for example by engine vibrations or by road shocks, and may be transmitted through the chassis frame to any parts attached thereto or to any parts attached to the engine. If the engine speed is such that its frequency is similar to the natural frequency of vibration of such parts, any slight primary state of unbalance of the engine may set up vibrations of a resonant character in these parts. Or, as is more likely to happen in modern motor cars of the four-cylinder variety, if the engine speed is approximately half the natural frequency of vibration of such parts any secondary unbalance of the engine may set up vibrations of a resonant character in these parts. The object of this invention is to damp out the vibrations in such parts.

According to this invention, a method of damping out vibrations in parts of a vehicle, such as the chassis frame, or any parts prone to vibration mounted thereon or mounted upon the engine, consists in attaching to one or more of said parts a freely vibratory system, the natural frequency of which is selected to be equal to or approximately equal to that of the disturbing force when such is a periodic alternating disturbance arising from the engine or other source, or that of the part to which it is attached when the disturbing force is not vibratory. As the vibrations of greatest magnitude will occur in any part when the frequency of the external disturbance is equal to the natural frequency of vibration of the part, the frequency of the freely vibratory system would generally be selected to be equal to that of the natural frequency of the part on which it was mounted so as to eliminate vibrations of a resonant character. If the engine speed is to be maintained steady for a considerable length of time at a speed which, while not such as to set up wholly resonant vibrations, nevertheless produces vibrations of an objectionable character in such parts, the natural frequency of the freely vibratory system is selected to be that of the disturbance transmitted from the engine.

One feature of the invention consists in that means are provided whereby the natural frequency of the freely vibratory system may be adjusted. This adjustment may be of a permanent character, or in case of a mass supported on a resilient arm may take the form of a leading screw or some similar mechanism by which the position of the mass on the arm may be altered. This method of adjustment would allow of an alteration being made in the frequency of the freely vibratory system even while it was in motion due to the engine running.

A convenient construction of such a device comprises a resilient arm fixed at one end to a spoke of the steering wheel near the rim thereof and extending from said end radially towards the steering column axis. On its inner free end, which is free to vibrate in any plane passing through the direction of the supporting arm, a mass is supported; the mass is preferably adjustable along the arm and a position is selected so that the system is most efficient as a damper in respect of the particular vibrations which require to be eliminated. This adjustment may be in the nature of a permanent adjustment or by a leading screw or similar mechanism capable of being made while the system is vibrating. The radial arm and its mass may, if desired, be enclosed in a sheath fixed to the wheel and containing a liquid for damping the vibrations of the arm and the mass in relation to the wheel.

A convenient alternative construction to the one described is where the resilient radial arm is attached directly to the rim of the wheel and the sheath forms the spoke so that the construction is essenti-

ally a hollow spoke with the vibrating radial arm and mass contained inside.

Dated 9th day of February, 1934.

BOULT, WADE & TENNANT,
Chartered Patent Agents,
111 and 112, Hatton Garden, London,
E.C.1.

COMPLETE SPECIFICATION

Improvements in or relating to Vibration Dampers for Vehicles

I, JOHN ALEXANDER GILMORE, a British Subject, of The University, P.O. Box. 594, Cape Town, South Africa, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention is for improvements in or relating to vibration dampers for vehicles. It is well known that in automobiles undesirable vibrations occur in various parts, which vibrations should, where possible, be damped. These vibrations may be set up, for example by engine vibrations or by road shocks, and may be transmitted through the chassis frame to any parts attached thereto or to any parts attached to the engine. If the engine speed is such that its frequency is similar to the natural frequency of vibration of such parts, any slight primary state of unbalance of the engine may set up vibrations of a resonant character in these parts. Or, as is more likely to happen in modern motor cars of the four-cylinder variety, if the engine speed is approximately half the natural frequency of vibration of such parts any secondary unbalance of the engine may set up vibrations of a resonant character in these parts.

It has been proposed in United States Specifications Nos. 1,867,753, 1,867,752 and 1,867,708 to damp out vibrations set up in the chassis of a motor car by road shocks by means of a vibratory system comprising a mass supported on the chassis by means of a spring, the natural frequency of the system being designed to be equal or approximately equal to the frequency of the vibrations to be damped.

In United States Specifications Nos. 1,867,753 and 1,867,752 the springs are laminated springs and, with the masses, are not enclosed and it is stated that the energy that would otherwise be effective to create the undesired vibrations is absorbed in vibrating the springs against the friction between their leaves.

In British Specification No. 262,517 it is proposed to damp vibration in the steering wheels of motor vehicles by means of a vibratory system comprising a mass supported by a spring arm on the stub axle of the wheel. It is stated that the periodicity of the system should be different from the periodicity of the wheel in order to produce the required damping. The vibratory system is not enclosed or damped frictionally.

In United States Specification No. 1,855,570 it is proposed to damp vibrations in electric motors or other mechanisms subjected to vibration by means of a plurality of vibratory systems each comprising a mass adjustably secured on one end of a resilient rod secured at its other end to the motor casing or a part of the mechanism and having a natural period of vibration that is substantially the same as the period of the vibrations it is desired to damp. The rods and masses supported thereby are not enclosed or damped frictionally.

According to the present invention there is provided a device for damping out vibrations set up by a disturbing force in a part of a vehicle, comprising an elongated liquid-tight casing adapted to be secured to the said part, a resilient rod arranged inside the casing and secured at one end to one end of the casing and a mass adjustably secured on the other end of the rod, which rod and mass form a vibratory system of which the natural frequency is approximately equal to that of said part of that of the disturbing force when such force is a periodic alternating force.

In order to extend the range of vibrations over which the device is effective, the casing may be filled with a viscous liquid such as oil so that the vibratory system is damped and responds to a wider range of frequencies.

Preferably the casing forms a portion of the part the vibrations of which it is desired to damp.

The invention also includes the combination with the steering wheel of a vehicle of the device in accordance with this invention secured to the wheel with the rod extending radially and inwardly of the wheel. The wheel is preferably provided with a hollow spoke that constitutes the casing. The device may, however, be applied to, or formed as a part of, other parts of a vehicle that are subject to vibration.

The following is a description of two embodiments of the invention, reference being made to the accompanying drawing, in which:—

Figure 1 is a part elevation and part section of a device suitable for clamping to a vibratory part;

Figure 2 is a section on the part 2—2 of Figure 1; and

Figure 3 is a part section and part elevation of a vibration damping device as applied to a steering wheel of a motor car.

Like reference numerals refer to like parts throughout the Figures of the drawing.

In the construction shown in Figures 1 and 2, the vibration damper comprises a rod 1 of circular cross-section and formed from resilient metal, such as steel. The rod is provided with a tapered end which is secured in a tapered hole 3 in a base 2. The arm carries a mass 5 in the form of a short cylinder which is mounted so that it may be slid along the resilient rod into different positions. The mass may be fixed in any one position by means of a set screw 6. The mass and rod are enclosed within a tubular sheath or casing 7 which is internally threaded at one end to engage a threaded part of the base 2. A washer 8 is located between the end of the sheath 7 and the base 2 in order that a fluid tight joint may be provided, since, under certain circumstances, it is found advantageous to fill the sheath or casing with a comparatively viscous liquid, such as oil, whereby a resistance to the vibrations of the rod and mass may be introduced. The effect of the oil resistance is to make the damper effective over a wider range of frequencies. The base 2 is provided with a clamp 11 and screws 9 whereby it may be secured to the parts subject to vibration. In the present instance, the clamp is shown suitable for attachment to the spoke 10 of the steering wheel of a motor car.

In the construction shown in Figure 3, there is shown an arrangement in which the vibration damper is formed integral with a steering wheel. In this case, the spokes of the wheel are formed hollow and their outer ends are internally threaded to receive the base 13 to which the resilient rod 1 is fixed. The outer face of the base 13 is shaped to receive the rim or circumference 15 of the steering wheel which is attached to the base by set screws 14. The inner end of the spoke 12 may also be internally threaded and may be arranged to engage a threaded boss 16 on the hub of the steering wheel. If desired, the spoke may be filled with oil in order to provide resistance to the vibratory motion of a mass rod.

In order to damp out the objectionable vibrations, the natural frequency of the vibratory system comprising the rod 1 and mass 6 should be selected to be equal to or approximately equal to that of the disturbing force. The frequency of the vibratory system is a function of the stiffness of the resilient rod 1 and the mass 6. It will be appreciated that the same frequency may be provided by a system having a large mass and a large degree of stiffness as by a system having a small mass and a small degree of stiffness, but the amplitude of the vibrations in the latter arrangement will be greater than in the former. In practice, the amplitude of vibrations permissible for the vibratory system will be governed by such conditions as space, but it has been found that a very much smaller mass in the vibratory system can be employed than that of the mass of the vibrating part required to be damped. For example, a mass as low as 2 per cent. of the mass of the primary vibrating part may be employed. It is a matter of comparatively simple experiment to determine the frequency of the objectionable vibrations, and then either by calculation or experiment to design the vibratory system for counteracting said objectionable vibrations.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A device for damping out vibrations set up by a disturbing force in a part of a vehicle, comprising an elongated liquid-tight casing adapted to be secured to the said part, a resilient rod arranged inside the casing and secured at one end to one end of the casing and a mass adjustably secured on the other end of the rod, which rod and mass form a vibratory system of which the natural frequency is approximately equal to that of said part or that of the disturbing force when such force is a periodic alternating force.

2. A device according to Claim 1 wherein the casing is filled with a viscous liquid.

3. A device according to Claim 1 or Claim 2 wherein the casing forms a portion of the part the vibrations in which it is desired to damp.

4. The combination with a steering wheel for a vehicle of a device according to Claim 1 or Claim 2 secured to the wheel with the rod extending radially with the fixed end towards the periphery of the wheel and its free end towards the centre of the wheel.

5. The combination according to Claim

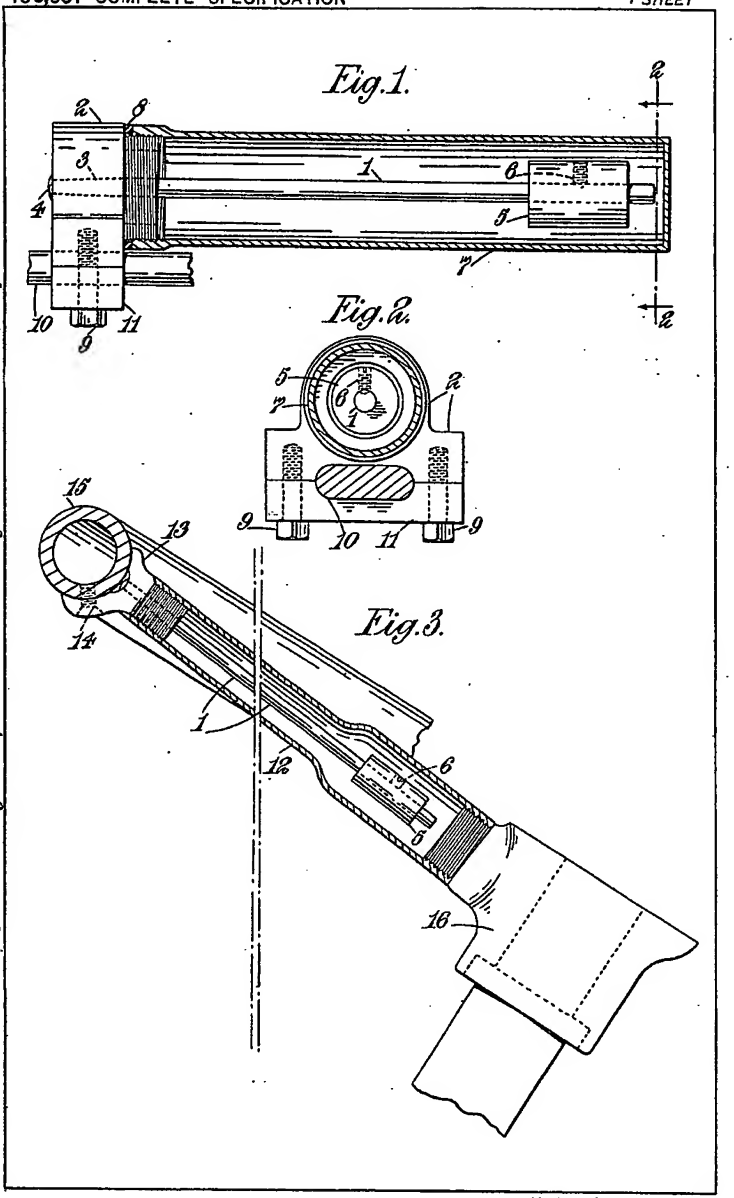
4 wherein the wheel is provided with a hollow spoke that constitutes the casing.

6. A device for damping vibrations in a vehicle substantially as shown in Figures 1 and 2 or in Figure 3 of the accompanying drawing.

Dated this 11th day of March, 1935.

BOULT, WADE & TENNANT,
Chartered Patent Agents,
111/112, Hatton Garden, London, E.C.1.

Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press —1935.



[This Drawing is a reproduction of the Original on a reduced scale.]

Malby & Sons, Photo-Lith.